WIDEBAND TEST SET
HALCYON
704A
SHOP

MODEL 704A

WIDEBAND TEST SET

1.0 GENERAL INFORMATION

1.1 The HC-704A is a wideband transmission test set with level, noise, and three level integrating impulse noise measurements complying with applicable requirements of Bell Technical Reference 41009. It is compact (5½" X 7" X 12") and lightweight (less than ten pounds) and comes with a battery (optional) to make the HC-704A a completely portable unit. Design features of the 704A include:

1.2 *Dual Digital Displays.* Different colored parameter and frequency displays make measurement of frequency response less time consuming and more fool-proof.

1.3 *Holding Tone Oscillator.* The HC-704A has a standard 1004 Hz tone which may be used to measure loss, C-notched noise, impulse noise, or other tests where such a tone is desired or required.

1.4 *Voice Frequency Channel.* The transmitter tunes from 50 Hz to 4 kHz with both C-message and 3 kHz flat weighting networks to measure noise on VF and Message circuits. A 1010 Hz notch filter can be used to notch out the 1004 Hz tone. This notched noise measurement feature is required for all transmission facilities which contain compandered carrier links such as WECO Type N and Type T.

1.5 *Program Channel.* The transmitter tunes from 300 Hz to 20 kHz and the receiver program channel weighting network is used to measure noise on such circuits. The Receiver measurements can also be performed using 15 kHz Flat weighting.

1.6 *Wideband Channel.* The transmitter tunes from 2 kHz to 110 kHz, and a 50 kHz weighting network is provided to measure noise. This feature is useful in checking wideband DDS circuits.

1.7 *Impulse Noise Measurements.* Thumbwheel switches set thresholds for three level impulse noise measurements. Measurements are made over time periods of five minues, fifteen minutes, or continuous. Impulse noise hits greater than the threshold, the threshold +4, and the threshold +8 are recorded and displayed on the measurements display when selected.

HC-704A Wide Band Test Set

2.0 PERFORMANCE SPECIFICATIONS

2.1 *Transmitter:*

Oscillator Range	50 kHz to 110 kHz
Holding Tone	1004 Hz
Output Level	-40 dBm to +13 dBm
Level Variations	±0.1 dB, 200 Hz to 4000 Hz ±0.20 dB, 4 kHz to 15 kHz ±0.50 dB, 50 kHz to 110 kHz
Tuning Range	
Tri-band	50 Hz to 4 kHz; 2 kHz to 20 kHz; 11 kHz-110 kHz
Tuning Mode	Manual — Continuous
Impendance	600, 900 and 135 ohms
Total Harmonic Distortion	
300 Hz-3000 Hz	>50 dB below signal
50 Hz-110 kHz	>40 dB below signal
1004 Hz (Hold-Tone)	>60 dB below signal

2.2 *Level Measurements:*

Frequency Range	50 Hz to 110 kHz
Measurement Accuracy	±0.1 dB, 200 to 4 kHz ±0.20 dB, 4 kHz to 15 kHz ±0.50 dB, 50 to 110 kHz
Level Measurement Range	-50 dBm to +13 dBm
Impedance	600, 900, 135 ohms or bridging 20K ohms
Resolution	0.1 dB

2.3 *Noise Measurements:*

Measurement Range	10 to 99 dBrn
Weighting	C Message 3 kHz Flat, 15 kHz Flat, Program Channel or 50 Kbit (497F)
Notch Resolution	50 dB attentuation from 995-1025 Hz

2.4 *Impulse Noise Measurement:*

Three-level spacing	> 0 > +4 > +8
	Program or 50 kHz notched
Threshold, 1st	40 to 99 dBrn 1 dB steps
Timer	5, 15 minutes; continuous
Counter Capacity	999

2.5 *Frequency Measurements:*

Range Frequency Level	50 Hz-110 kHz
Accuracy	±1 digit
Update	8 times/sec.
Frequency Resolution	1 Hz-VF; 10 Hz wideband

Figure 1. Figure 2.

3.0 OPTIONS

3.1 *Battery Option.* Five-and nine-volt rechargeable battery packs. If you plan to use the HC-704A as a portable unit, order the HC-704A-02, which has the battery option (part no. 8220-1135-05). Power is supplied by two rechargeable, internally mounted battery packs. A charge will last up to five hours, and the batteries can be recharged in eight hours. The packs have a life of 200 to 400 in/out charges or, approximately, two years.

3.2 *Rack Mount Option.* If the HC-704A is to be used in a stationary installation, order the rack mount option (part no. 8220-1136-04). Installation instructions are included with the rack mount.

3.3 *705A Dial and Hold Unit.* Used to access and hold a circuit interconnected to both the input and output circuits. Once the circuit has been accessed and is being held, the transmit and receive lines can be interchanged by a transfer switch. If the dial-and-hold unit is ordered separately (part no. 9500-0004-19), ask for HC-705A. When

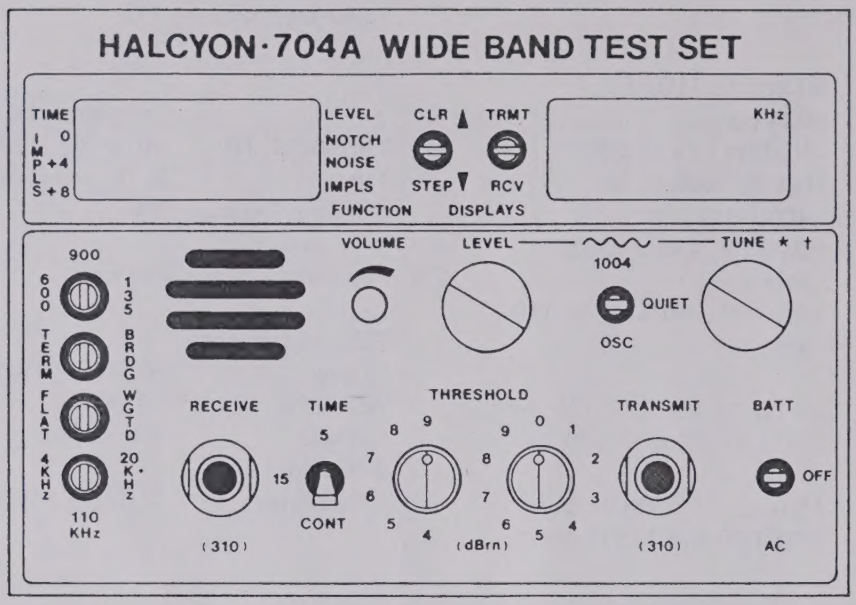


Figure 1.

ordered in combination with the HC-704A and the battery pack option (part no. 9500-0004-18), the model number is HC-704A-03.

3.4 These options require no special modifications, and can be ordered at any time.

4.0 INSTALLATION INSTRUCTIONS

4.1 The HC-704A should be inspected carefully as soon as it is received. If any evidence of damage is seen, a claim should be filed with the carrier as per Warranty instructions.

4.2 The HC-704A is designed as a lightweight, portable-type unit; therefore, no installation is required except for mounting brackets on rack mounted units. If your unit does not come with the Battery option, remove the rear dust cover and insert the AC power cord.

5.0 DESCRIPTION OF CONTROLS

A. Toggle Switches

Figure 1.

5.1 *BATT/ON/OFF Toggle Switch.* Three-position switch which controls power to the unit. If your unit does not have the battery option, the BATT position should never be used since charging current is too low and is not highly filtered. Use only the AC position. If your unit has the battery option, the BATT position should be used only when AC power is unavailable. The battery will charge with the switch in either the AC or OFF position, but will discharge only when the unit is in the BATT position.

5.2 *5/15/C Toggle Switch.* Three-position time switch which chooses the elapsed time interval for impulse hit measurements. Selection is provided for five minute, fifteen minute, or continuous test periods.

5.3 *TRMT/RCV Toggle Switch.* Two-position mode switch that chooses whether the transmitted or received parameters are to be displayed.

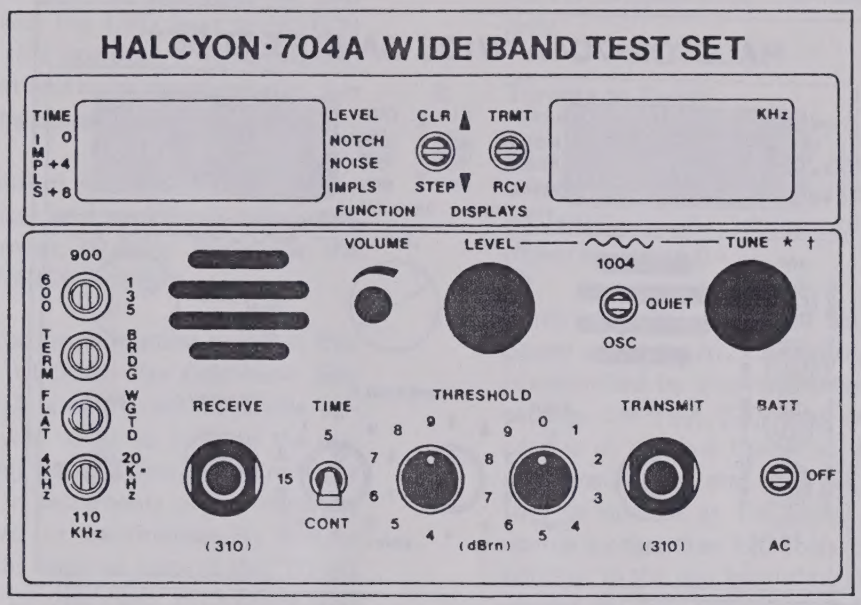


Figure 2.

5.4 *CLR/STEP Toggle Switch.* With the TRMT/RCV switch (5.3) in the RCV position, the STEP switch selects the mode and measurement displayed. The modes are Level (both Receive and Transmit Display), Notched Noise, Noise, and Impulse Noise (Receive Display only). When in Impulse Noise position, the time parameter will be displayed, and repeated selection of STEP will increment it through Impulse Noise, 0, +4, and +8. Moving the switch to CLR (Clear) resets the displays and time count to zero and the count resumes.

5.5 *135/900/600 Toggle Switch.* Changes output/input terminating impedance and associated measurement sensitivity selection is provided of 135, 900, and 600 ohms.

5.6 *BRDG/TERM Toggle Switch.* Either terminates or bridges the line.

5.7 *FLAT/WGTD Toggle Switch.* Either a flat or weighted filter.

5.8 *4/20/110 kHz Toggle Switch.* Selects either the voice frequency (4 kHz range), program frequency (20 kHz range), or wideband (110 kHz range).

5.9 *1004/QUIET/OSC.* Three-position switch which selects a 1004 Hz oscillator, a line termination or a voltage controlled OSC (VCO).

B. Knobs

Figure 2.

5.10 *LEVEL.* The LEVEL control adjusts the output level of the transmitted signal. TRMT Display and LEVEL function must be selected to provide a display of the transmit output level.

5.11 *TUNE.* When the 1004/QUIET/OSC oscillator switch (5.9) is in the OSC position, the TUNE control will change the frequency of the transmitted signal. The 4/20/110 Switch determines the range of frequencies tuned.

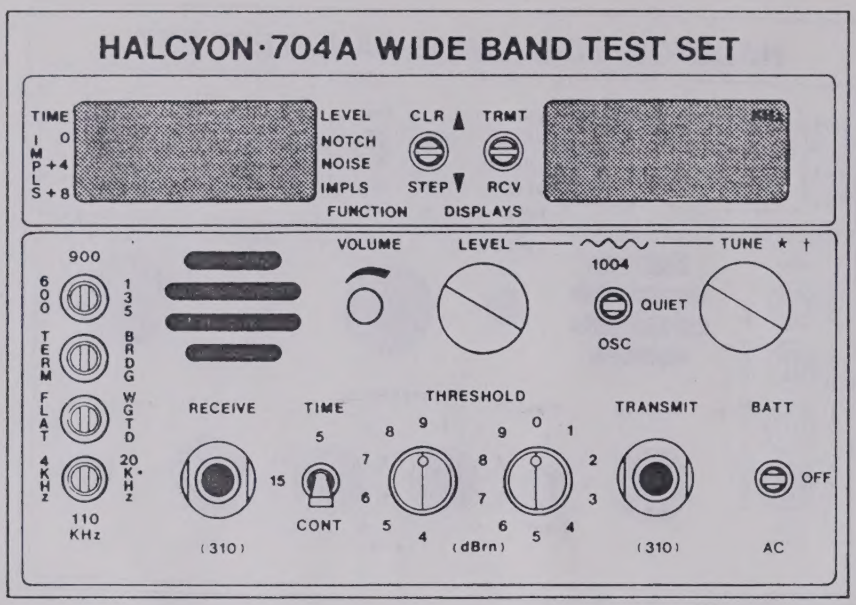


Figure 3.

NOTE: The TRMT/RCV switch (5.3) must be in the TRMT position to monitor output frequency.

5.12 *VOLUME and Speaker.* Allows the operator to listen to the transmitted or received signal dependent upon the position of the TRMT/RCV switch (5.3). This knob controls the speaker located to the left of the VOLUME knob.

5.13 *THRESHOLD.* These two control received threshold level for impulse noise measurements. The control range is from 40 dBrn to 90 dBrn in 1 dB steps. Impulse noise counts are made when the noise exceeds the threshold setting, threshold +4, and threshold +8 dB.

C. Jacks

Figure 2.

5.14 *RECEIVE Jack.* A 310 jack that the operator uses to introduce the received signal to the HC-704A.

5.15 *TRANSMIT Jack.* A 310 Jack that the operator uses to connect the transmit signal to a line.

D. Displays

Figure 3.

5.16 The right-hand or frequency display is green and displays either the transmit or receive frequency (See Paragraph 5.3).

5.17 The left-hand display displays either level, notched noise, noise or impulse noise measurements as selected by the STEP switch. The particular display is noted by 8 LEDs which surround the display. The first mode is level and is indicated by the LED in front of LEVEL. In this mode, the transmit or receive level will be displayed dependent upon the position of the TRMT/RCV switch (5.3).

The second mode is notched noise. To select this mode, the operator depresses the step switch (5.4) and the LED next to NOTCH will light. In this position, a 1010 notched filter is present and noise measurements, less the tone, can be made.

5.18 The third position is noise, which removes the Notch Filter and provides a noise-with-tone measurement. When in this mode, the LED next to NOISE will light.

5.19 The fourth position is impulse noise; in this position, the LED on the right-hand side opposite IMPLS and the left-hand side opposite TIME will be lit to indicate the display is showing elapsed time. Measurements can be made in increments of five minutes, fifteen minutes, or continuous. By hitting the step switch, impulse noise at the "0" set threshold will be displayed. Hitting the step switch again, impulse noise +4 above threshold will be displayed, and the LED next to +4 will be lit. Hitting the switch once more, the display will show impulse noise +8 above threshold and the LED next to +8 will be lit.

E. Rear Panel

5.20 An AC connector is on the rear panel. A fuse holder next to the connector contains a fuse and a voltage selector card. The card and fuse are factory-set to operate at 120 volts. If other than 120 volts is available, the adjustment is made by orienting the card to the proper voltage setting. (See Paragraph 6.4).

6.0 OPERATING PROCEDURE

A. General

6.1 The HC-704A has the capability of both sending and receiving signals, and of measuring signal and noise levels. Instructions for operating the equipment are given in this section.

6.2 Preset the impedance switch to the desired terminating impedance (900, 600, or 135 ohms).

NOTE: The TERM/BRDG and FLAT/WGTD switches affect the receive line input only.

B. Turning on Power

6.3 When the HC-704A is used as a portable unit without access to external power (and is equipped with the battery option), turn the power switch to BATT.

6.4 When plugged into an AC source, turn the power switch to AC. Operating voltage range is controlled by a voltage selector card with settings for 120, 220, and 440 volts. The card is in the fuse holder at the rear of the instrument. Fuse and card are set at the factory to operate at 120 volts. If the voltage source is other than 120 volts, open the small window in the rear by sliding it to the left to expose the fuse and voltage selector card. A lever marked FUSE PULL releases the fuse. Pull out the card with either needle-nose pliers or by inserting a pointed tool into the small hole at the card's trailing edge. Orient the card so the desired voltage reads right side up. Re-insert the card and the appropriate fuse.

C. Transmitting

6.5 STEP the function switch to activate the LEVEL LED indicator. Set the display switch to TRMT. Set the 1004/QUIET/OSC switch to the QUIET position.

NOTE: Both displays should be blank, with the exception of the red minus (-) sign on the left display.

6.6 If you are making tests on dial-up circuits, connect the optional Dial-and-Hold panel (HC-705A) to the HC-704A, and dial the desired signal with a dial handset. Instructions for using the HC-705A come with the equipment.

6.7 Connect the Transmit line to be tested by plugging into the TRANSMIT jack.

6.8 If 1004 Hz is to be transmitted, set the oscil-

lator switch to the 1004 position. Observe 1004 kHz on the frequency display. Adjust the transmitted level with the LEVEL knob unit the display shows the desired output in dBm.

6.9 For transmitting frequencies other than 1004 Hz, set the oscillator switch to OSC; set the frequency range switch to the applicable position (4 kHz, 20 kHz, or 110 kHz); rotate the TUNE knob until the desired frequency is displayed.

D. Receiving

6.10 Set the display switch to the RCV position. STEP the function switch so that the LEVEL LED is activated. Connect the line to be tested to the RECEIVE jack.

6.11 Set the TERM/BRDG switch according to whether you want to make a terminated or bridging measurement.

6.12 At this point, the received level and frequency are displayed. To measure noise, STEP the function switch to either NOTCH (if a 1010 notch filter is to be used) or NOISE, and make the following measurements:

6.13 *Idle Nose: 4 kHz Range.* Idle noise measurement is made with a quiet termination provided at the far end. Place the FLAT/WGTD filter switch in either the FLAT position (for 3 kHz flat) or the WGTD position (for C-message weighting). The 3 kHz flat curve is useful in detecting low frequency noise. This noise typically originating from power line induction is not detectable using the C-message curve.

NOTE: The idle noise measurement procedure will yield erroneous results on telephone circuits which contain compandered facilities; therefore, the noise-with-tone technique (Paragraph 6.13) is usually specified as the required measurement on these facilities.

The results of idle noise measurement must be converted to dBrnO to determine the degree of conformance with circuit specifications. The formula for conversion of dBrn to dBrnO is: dBrnO equals dBrn minus TLP.

Example:
dBrn = 50
TLP = -3
dBrnO = 50-(-3)
= 50 +3
= 53 dBrnO

6.14 *Noise with Tone, 4 kHz Range.* At the transmit end, a 1004 Hz tone must be sent at the required level (-13 dBmO).

NOTE: Transmission measurements are typically made at 13 dB below the prevailing TLP (-13 dBmO). Also, the associated sending instrument of other than a Halcyon Test Set must have total harmonic distortion characteristics of better than -50 dB pure.

At the receive end, STEP the function switch to NOTCH. The reading on the level display will be in dBrn. To detect presence of low frequency noise, use the 3 kHz flat curve. Unless otherwise specified, noise with tone measurements are made using CMSG weighting.

6.15 *Signal-to-Noise Measurement — 4 kHz Range.* Signal to noise may be measured directly as the difference between the notch-noise reading and the noise reading. First, STEP the function switch to NOTCH, record the reading with a 1004 Hz tone sent by the transmitter. Next, make the same measurement with the function switch stepped to NOISE. The difference between the two readings is signal to noise.

6.16 *Program Range (20 kHz) Noise Measurement.* Program noise measurements are inherently idle noise measurements. On this basis, the far-end set must provide a QUIET termination. At the receiving end, the function switch should be stepped to the NOISE position. The kHz range switch should be at 20 kHz. Either flat weighting or 15 kHz program weighting may be selected as required with

the FLAT/WGTD filter switch. Here again, program noise measurements will be in terms of dBrn, and may be converted to dBrnO, as required.

6.17 *Impulse Noise Measurement.* Impulse noise can be measured with the 1004 Hz tone to provide a reference signal, or without the tone to simulate the actual operating condition. Control switches should be set as follows: the TERM/BRDG switch is in the terminated position; the filter switch is in the WGTD position, the frequency range switch will be in the position that corresponds to the line being tested (voice, program, or wideband). Step the function switch to NOTCH for a reading of the notched noise level. That level is reproduced with the THRESHOLD thumbwheel switches to set the impulse threshold level, and the TIME switch is set at 5 minutes, or CONT, as desired. Then step the function switch to IMPLS. An LED will simultaneously light up at TIME on the left side of the display. Then flip the function switch to CLR to clear the display and reset the time count. Transient disturbances will flash momentarily and opposite 0, +4, or +8 depending on the level of the occurrence. When the internal set by the TIME switch elapses, the process stops. STEP the function switch through the rest of its cycle. The display will show the number of impulses that occurred at the threshold level (0), threshold +4 dB, and threshold +8 dB for the period set by the TIME switch.

CAUTION: In the final step, do not flip the function switch to CLR. That would wipe out the accumulated data, and reset the timer and count to zero.

6.18 *Test Set Filters.* The filter switch and kHz range switch work together to provide six filter arrangements. Refer to Figure 3 as a guide to these settings:

4 kHz	+ WGTD =	C-message weighted filter
4 kHz	+ FLAT =	3 kHz filter
20 kHz	+ WGTD =	program filter
20 kHz	+ FLAT =	15 kHz filter
110 kHz	+ WGTD =	497F filter
110 kHz	+ FLAT =	50 kHz flat filter

E. Transmit – Receive Transfer Functions

6.19 Bi-directional loop-around measurements may be readily made using the Dial and Hold optional panel (HC-705A). The Dial and Hold panel is connected to both the RECEIVE and TRANSMIT jacks in the testing procedure. Instructions for operating the Dial and Hold panel come with the unit.

Filters	VF	Program	Wide Band
WEIGHTED	C-Message FREQ Hz — dB BELOW REF 60 — 55.7 ± 2 dB 100 — 42.5 ± 2 dB 200 — 25.0 ± 2 dB 300 — 16.5 ± 2 dB 400 — 11.4 ± 1 dB 500 — 7.5 ± 1 dB 600 — 4.7 ± 1 dB 700 — 2.7 ± 1 dB 800 — 1.5 ± 1 dB 900 — 0.6 ± 1 dB 1000 — 0 2000 — 0.2 ± 1 dB 1300 — 0.5 ± 1 dB 1500 — 1.0 ± 1 dB 1800 — 1.3 ± 1 dB 2000 — 1.3 ± 1 dB 2500 — 1.4 ± 1 dB 2800 — 1.9 ± 1 dB 3000 — 2.5 ± 1 dB 3300 — 5.2 ± 2 dB 3500 — 7.6 ± 2 dB 4000 — 14.5 ± 3 dB 4500 — 21.5 ± 3 dB 5000 — 28.5 ± 3 dB	Program FREQ Hz — dB R F to 1000 Hz 100 — −26.3 ± 2 dB 200 — −17.3 ± 2 dB 300 — −12.2 ± 2 dB 400 — −9.0 ± 2 dB 500 — −6.6 ± 1 dB 600 — −4.7 ± 1 dB 800 — −2.0 ± 1 dB 900 — −0.8 ± 1 dB 1000 — 0 1500 — +3.2 ± 1 dB 2000 — +4.8 ± 2 dB 2500 — +5.6 ± 2 dB 3000 — +6.0 ± 2 dB 4000 — +6.5 ± 2 dB 5000 — +6.5 ± 3 dB 6000 — +6.4 ± 3 dB 7000 — +5.8 ± 3 dB 8000 — +4.0 ± 4 dB 9000 — −1.5 ± 4 dB 10,000 — −8.5 ± 4 dB	50 KB/S FREQ Hz — dB REF to 1 kHz 20 — 10.2 ± 3.0 dB 50 — 2.7 ± 1.5 dB 200 — 0.2 ± 0.5 dB 1000 — 0.0 ± 0.2 dB 5000 — 0.1 ± 0.5 dB 10,000 — 0.3 ± 0.5 dB 15 000 — 0.7 ± 0.5 dB 20 000 — 1.3 ± 0.5 dB 25 000 — 2.1 ± 0.5 dB 30 000 — 3.3 ± 0.5 dB 35,000 — 5.0 ± 1.0 dB 40,000 — 7.8 ± 1.5 dB 45,000 — 14.0 ± 2.0 dB 50 000 — 22.0 dB 1 dB 55 000 — 30.0 dB 1 dB
FLAT	3 kHz Flat FREQ Hz — dB BELOW REF 30 — 0 + 2.5 60 — 0 + 1.75 250 — 0 + 1.0 1000 — 0 2000 — 0.5 + 1.75 2500 — 1.5 + 2.0 3000 — 3.0 + 3.0	15 kHz Flat FREQ Hz — dB REF to 1000 Hz 30 — 0 ± 1.5 60 — 0 ± 1.75 250 — 0 ± 1.0 1000 — 0 ± 10,000 — 0.8 ± 1.5 15,000 — 3.0 ± 3.0 20,000 — 6.2 ± 3.0 30,000 — 12.3 ± 3.0	

4. TEST AND CALIBRATION

A. 704A Acceptance Test Procedure

4.01 The following test procedure verifies proper operation of the 704A.

4.02 Equipment Required. The following test equipment is required:

(a) Multimeter.

(b) RTS Voltmeter Hewlett-Packard 3400A or equivalent.

(c) Distortion Analyzer.

(d) Frequency Counter.

(e) Oscillator.

(f) Oscilliscope.

(g) Attenuator.

4.03 Set-Up.

(a) Set the 704A controls as follows:

Function	LEVEL
Mode Switch	XMIT
Oscillator Switch	OSC.
Power Switch	OFF
Speaker Volume Pot	MIN (Anti-clockwise)
Level Pot	MAX (Clock-wise)
Frequency Pot	MIN (Anti-clockwise)
Termination	TERM
Impedance	600
Weighting	WGTD
Frequency Range	4 kHz
Time	CONT

(b) Check that the tip and ring of the RECEIVE and TRANSMIT jacks are not connected to ground.

(c) Check that the sleeves of both jacks are connected to ground.

(d) Set power switch to AC.

4.04 Transmitter level Test.

(a) Connect RMS voltmeter with 600 ohms +/-1 ohm termination to TRANSMIT jack of 704A.

(b) Set the frequency of the 704A to 1 kHz. Adjust the LEVEL control to obtain the following readings on the RMS meter. Check that the level displays are within the limits indicated.

RMS METER	DISPLAY
+13.0 dB	+13.0 +/-0.3 dBm
0.0 dB	0.0 +/-0.1 dBm
-40.0 dB	-40.0 +/-0.3 dBm

4.05 Transmitter Frequency Range Test.

(a) Check that the frequency range is at least 50 Hz to 4 kHz in the 4 kHz mode; at least 4 kHz to 20 kHz in the 20 kHz mode; and at least 20 kHz to 110 kHz in the 110 kHz mode.

(b) Check that the resolution for frequency display is 1 Hz in the 4 kHz mode and 10 hz in the 20 kHz and 110 kHz modes.

4.06 Transmitter Frequency Response Test.

(a) Set transmit level at 0.0 dBm.

(b) Vary the frequency while checking that the displayed level remains within the following limits:

FREQUENCY	LEVEL
50 Hz - 200 Hz	0.0 +/-0.5 dBm
200 Hz - 4 kHz	0.0 +/-0.2 dBm
4kHz - 110 kHz	0.0 +/-0.5 dBm

(c) Set transmit level to 0.0 +/-0.1 dBm.

(d) Use the distortion analyzer to measure the transmitter distortion at the following frequencies. Check that the distortion is less than the maximum indicated.

FREQUENCY	MAXIMUM DISTORTION
50 - 300 Hz	-40 dB
300 Hz	-45 dB
1 kHz	-49 dB
3 kHz	-45 dB
3 kHz - 110 kHz	-40 dB

(e) Repeat tests in steps (a) through (d) with 900 ohms and 135 ohms terminations.

(f) Set termination switch to 600 ohms.

4.07 Transmitter 1004 Hz Test.

(a) Set 1004/QUIET/OSC switch to 1004 Hz. Frequency display should read 1.004 +/-.002 kHz.

(b) Adjust transmit level for an RMS voltmeter reading of 0.0 +/-0.1 dBm. Level display should read 0.0 +/-0.1 dBm.

(c) Use the distortion analyzer to check that the distortion is less than -50 dBm.

(d) Set the 1004/QUIET/OSC switch to OSC and adjust the frequency to 1 kHz. The level change when switching from OSC to 1004 should be less than 0.2 dB.

4.08 Transmitter Impedance Test.

(a) Set transmit level to 0.0 dBm and measure the transmitter output with an RMS voltmeter. RMS voltage should be between 0.756 and 0.792 VRMS (600 ohm termination).

(b) Switch the 135/900/600 switch to 900. The level display should still read 0.0 dB. The RMS voltage should be between 0.926 and 0.970 VRMS (900 ohm termination).

(c) Switch the 135/900/600 switch to 135. The level display should still read 0.0 dB. The RMS voltage should be between 0.358 and 0.375 VRMS (135 ohm termination).

4.09 Transmitter Quiet Mode Test.

(a) Switch 1004/QUIET/OSC switch to QUIET.

(b) Measure the transmitter output noise using the distortion analyzer in the noise mode. The noise level should be less than 20 dBrn.

(c) Check that the level and frequency displays are blanked except for the minus sign and decimal points.

4.10 Transmitter Noise Mode Test.

(a) Set TRMT/RCV switch to TRMT.

(b) Select NOTCH function. The level and frequency displays should blank out.

(c) Select NOISE function. The level and frequency displays should blank out.

4.11 Receiver Level Range Test.

(a) Connect the TRANSMIT jack to the RECEIVE jack of the 704A and to an RMS voltmeter.

(b) Set the transmitter frequency to 1000 Hz.

(c) Set the level to obtain the following readings on the RMS voltmeter. Check that the level display readings are within the limits indicated.

RMS VOLTMETER	LEVEL DISPLAY
+13.0 dB	13.0 +/-0.3 dB
0.0 dB	0.0 +/-0.1 dB
-10.0 dB	-10.0 +/-0.1 dB
-20.0 dB	-20.0 +/-0.1 dB
-30.0 dB	-30.0 +/-0.1 dB
-40.0 dB	-40.0 +/-0.3 dB
-50.0 dB	-50.0 +/-0.4 dB

(d) Connect an oscillator to the RECEIVE jack of the 704A. At some level greater than +13.0 dBm the display should blank. As the level is then decreased the display should return at some level greater than +13.0 dBm.

4.12 Receiver Frequency Response Test.

(a) Connect an oscillator to the RECEIVE jack.

(b) Set the oscillator level to 0.0 +/-0.0 dBm and vary the frequency from 50 Hz to 110 kHz. The frequency response should be as follows:

FREQUENCY	LEVEL DISPLAY
50 Hz - 300 Hz	0.0 +/-0.5 dBm
200 Hz - 15 kHz	0.0 +/-0.2 dBm
15 kHz -110 kHz	0.0 +/-0.5 dBm

4.13 Receiver Noise Measurement Test.

(a) Set Function to NOISE.

(b) Connect an oscillator to the RECEIVE jack and to an RMS voltmeter.

(c) Set the oscillator level to obtain the following readings on the RMS voltmeter. The level display should be within the limits indicated.

RMS VOLTMETER	LEVEL DISPLAY
0.0 dBm .7746	90 +/-1 dBrn
10.0 dBm .2450	80 +/-1 dBrn
-20.0 dBm .07746	70 +/-1 dBrn
-30.0 dBm .02450	60 +/-1 dBrn
-40.0 dBm .007746	50 +/-1 dBrn
-50.0 dBm .002450	40 +/-1 dBrn

4.14 Receiver Notch Filter Test.

(a) Select NOTCH function.

(b) Connect an oscillator to the RECEIVE jack. Set the level to 0.0 dBm. The oscillator distortion must be less than -55 dB.

(c) The level display should read less than 40 dBrn for all frequencies from 995 to 1025 Hz.

(d) Change the oscillator frequency to to 1300 Hz. The level display should read 90 dBrn +/-1 dB.

4.15 Receiver C-Message Filter Test.

(a) Set 704A to 4 kHz and WGTD, and select NOISE function.

(b) Apply a tone at 0.0 dBm to the 704A and check the frequency response.

FREQUENCY	LEVEL DISPLAY
400 Hz +/-1 Hz	78 dBrn +/-1 dB
3000 Hz +/-1 Hz	87 dBrn +/-1 dB
4000 Hz +/-1 Hz	75 dBrn +/-2 dB

4.16 Receiver 3 kHz Flat Filter Test.

(a) Set 704A to 4 kHz and FLAT, and select NOISE function.

(b) Apply a tone at 0.0 dBm to the 704A and check the frequency response.

FREQUENCY	LEVEL DISPLAY
400 Hz +/-1 Hz	90 dBrn +/-1 dB
1000 Hz +/-1 Hz	90 dBrn +/-1 dB
3 kHz +/-1 Hz	87 dBrn +/-2 dB
6 kHz +/-1 Hz	78 dBrn +/-2 dB

4.17 Receiver Program Weighting Filter.

(a) Set 704A to 20 kHz and WGTD, and select NOISE function.

(b) Apply a tone at 0.0 dBm and check the frequency response.

FREQUENCY	LEVEL DISPLAY
400 Hz +/-1 Hz	81 dBrn +/-2 dB
1000 Hz +/-1 Hz	90 dBrn +/-1 dB
3 kHz +/-2 Hz	96 dBrn +/-2 dB
8 kHz +/-10 Hz	94 dBrn +/-4 dB
10 kHz +/-10 Hz	82 dBrn +/-4 dB
15 kHz +/-10 Hz	68 dBrn +/-4 dB

4.18 Receiver 15 kHz Flat Filter Test.

(a) Set 704A to 20 kHz and FLAT, and select NOISE function.

(b) Apply a tone at 0.0 dB,m and check the frequency response.

FREQUENCY	LEVEL DISPLAY
400 Hz +/-1 Hz	90 dBrn +/-1 dB
1000 Hz +/-1 Hz	90 dBrn +/-1 dB
10.05 kHz +/-10 Hz	89 dBrn +/-1 dB
15 Hz +/-10 Hz	87 dBrn +/-2 db

4.19 Receiver Flat Filter Test.

(a) Set the 704A to 110 kHz and FLAT, and select NOISE function.

(b) Apply a tone at 0.0 dBm and check that the frequency response is -3 dB +/-1 dB at 50.5 kHz +/-1 kHz.

4.20 Receiver 497F Filter Test.

(a) Set the 704A to 110 kHz and WGTD, and set Function to Noise Mode.

(b) Apply a tone at 0.0 dBm and check the frequency response.

FREQUENCY	LEVEL DISPLAY
45 Hz +/-1 Hz	87 dBrn +/-3 dB
1 kHz +/-1 Hz	90 dBrn +/-1 dB
28 kHz +/-1 Hz	87 dBrn +/-2 dB
35 kHz +/-1 Hz	85 dBrn +/-1 dB
55 kHz +/-1 Hz	<60 dBrn

4.21 Receiver Impedance and Termination Test

(a) Set the 704A to 4 kHz and WGTD.

(b) Connect the 530B oscillator signal to the 704A receiver.

(c) Switch the 704A to 900 and observe the level. The level should be -0.2 +/-0.1 dB.

(d) Switch the 704A to 135 and observe the level. The level should be -2.3 dB +/-.2 dB.

(e) Switch the 704A to 600 and BRDG and observe the level. The level should be 6.0 +/-0.2 dB. Set the switch back to "TERM."

4.22 Receiver Noise Floor Test.

(a) Disconnect all inputs to 704A.

(b) Set Function to NOISE. Level Display should be less than 10 dBrn.

(c) Set Function to NOTCH. Level Display should be less than 20 dBrn.

4.23 Impulse Hits Test.

(a) Apply a 1700 Hz tone to the 704A Receiver.

(b) Superimpose a 1004 Hz at 0.0 dBm +/-0.1 dB to the 704 Receiver.

(c) Set the 704A to 4 kHz, WGTD, and BRDG.

(d) Set the 704A Function to NOTCH.

(e) Adjust the level of the 1700 Hz signal for a level display reading that just changes from 78 to 79 dBrn.

(f) Set the threshold switches to 82.

(g) Step the 704A Function to Impulse +0 and clear the counters. The Impulse LED should be flashing, and the Impulse +0 LED should be ON. The display should be registering hits.

(h) Step the Function to Impulse +4. The Impulse +4 LED should be ON, and the Impulse +0 LED should be flashing. The display should not be registering hits.

(i) Set the threshold switches to 78. The display should be registering hits.

(j) Step the function to Impulse +8. The Impulse +8 LED should be ON, and the Impulse +4 LED should be flashing. The display should not be registering hits.

(k) Set the threshold switches to 74. The display should be registering hits.

4.24 Battery Operation and Impulse Timer Test.

(a) Unplug AC line and switch power to BATT.

(b) Step the 704A function to TIME.

(c) Set the time switch to 5.

(d) Clear the counters. The time LED should be ON and the Impulse LED should be flashing. The display should register the minutes. After 5 minutes the Impulse LED should stop flashing.

(e) Repeat test 4.06, 4.07, and 4.11 after 10 minutes.

4.25 Speaker Operation Test.

(a) Set 704A to Xmit Level of 0.0 dBm at 1000 Hz.

(b) Turn the Speaker Volume Pot from minimum to maximum (clockwise) and hear the increase in loudness. Set 704A to Xmit level of -40 dBm at 1000 Hz. Verify you can still hear the tone.

4.26 DC Blocking Test.

(a) Set 704A to "BRDG" and Xmit and 600 ohm term.

T+R

(b) Apply a 48 VDC across REC. and Xmit jacks. DC current drawn must be 0 mA. REVERSE LEADS AND CHECK FOR OMA CURRENT DRAWN.

4.27 15 Minutes Timer Test.

(a) Step the 704A function to TIME and clear the counters.

(b) Set the time switch to 15. The Time LED should be on and the Impulse LEd should be flashing. After 15 minutes, the Impulse LED should stop flashing.

(c) Set the time switch to CONT and clear the counters. Verify that the counter still counts after 15 minutes.

4.28 Mechanical Inspection Test.

(a) Check to see all switches and controls are working properly.

(b) Check to see that the displays are properly aligned.

. 704A Calibration Test Procedure

4.29 The following calibration procedure verifies proper adjustment of the 704A.

4.30 Documents Applicable.

SD-0002-88
SD=0002-89
SD-0002-90
SD-0002-91
SD-0002-93
SD-0002-94
SD-0002-95
SD-1104-00
ED-0002-88
ED-0002-89
ED-0002-90
ED-0002-91
ED-0002-93
ED-0002-94
ED-0002-95
ED-0002-96
ED-1104-00

4.31 Equipment Required:

(a) Multimeter.

(b) RMS Voltmeter, Hewlett-Packard 3400A or equivalent.

(c) Distortion Analyzer.

(d) Frequency Counter.

(e) Oscillator.

(f) Oscilliscope.

(g) Attenuator.

(h) DC power supply.

(i) Test fixture.

4.32 Set-Up:

(a) Set the 704A controls as follows:

Function	LEVEL
Mode Switch	REC
Impedance Switch	600 Ohms
Termination Switch	TERM
Weighting Switch	FLAT
Frequency Range	4 kHz
Time	CONT
Oscillator Switch	OSC

(b) Check that the tip and ring of the RECEIVE and TRANSMIT jacks are not connected to ground.

(c) Check that the sleeves of both jacks are connected to ground.

4.33 Test-Level Calibration.

(a) Input a 10.00 dBm signal at 1 kHz and check to make sure it is +10.0 dBm on 3400 RMS meter (600 ohm Termination).

(b) Adjust R2 (8000-002-89) for a reading of ~~+/-0.0~~ +10.0 on level display.

(c) ~~Attenuate~~ SET the oscillaor signal ~~by~~ TO ~~20~~ 0.00 dB.

(d) Adjust R1 (8000-0002-89) for a reading of ~~-20.0~~ 0.0 dBm on the level display.

(e) ~~Attenuate~~ SET the oscillator signal ~~by~~ TO ~~40 dB.~~ -40.00 DB

(f) Adjust R4 for (8000-0002-89) for a reading of -40.0 dBm on the level display.

(g) Repeat steps (a) thru (f) until the following conditions are met:

RMS VOLTMETER	DISPLAY READING
+13.0 dBm	+13.0 +/-0.2 dBm
0.0 dBm	0.0 +/-0.1 dBm
-10.0 dBm	-10.0 +/-0.2 dBm
-20.0 dBm	-20.0 +/-0.2 dBm
-30.0 dBm (R23 ADJ)	-30.0 +/-0.2 dBm
-40.0 dBm	-40.0 +/-0.2 dBm
-50.0 dBm (R93 ADJ)	-50.0 +/-0.2 dBm

4.34 Test - Noise Calibration:

(a) Set Function to Noise.

(b) Input a 0.0 dBm, 1000 Hz signal.

(c) Adjust R5 (8000-0002-89) for a reading of 90 dBrn on the level display.

(d) Attenuate the oscillator signal t 40 dB.

(e) Adjust R3 (8000-0002-89) for reading of 50 dBrn on the leve display.

(f) Repeat steps (a) thru (e) unti the following conditions are met:

RMS VOLTMETER	LEVEL DISPLAY
0.0 dBm	90 + 1 dBrn
-10.0 dBm	80 + 1 dBrn
-20.0 dBm	70 + 1 dBrn
-30.0 dBm	60 + 1 dBrn
-40.0 dBm	50 + 1 dBrn
-50.0 dBm	40 + 1 dBrn

*4.35 Test Xmitter Level Calibration:

(a) Set TRMT/RCV switch to TRMT.

(b) Adjust Level pot (front panel) un til the level display reads 0. dB.

(c) Adjust R10 (8000-0002-95) unti 3400 RMS Voltmeter (600 ohm ter minated) reads 0.0 +/-0.1 dBm.

4.36 Test - Xmitter Frequency Calibra tion:

(a) Set 704A to TRMT, OSC mode, and 3 kHz range at 0.0 dB, 300 Hz.

(b) Adjust R2, R3, R5, R4 (8000-0002 95) for distortion -50 dB.

(c) Change Xmit frequency to 50 Hz. Adjust R1 (8000-0002-95) for dis tortion -40 dB.

(d) Change Xmit frequency to 3000 Hz. Adjust R2 (8000-0002-95) for dis tortion -48 dB.

(e) Repeat steps (a) through (d) until the distortion specifications are satisfied.

*NOTE: FOR NEW 295 "F" BDS, ALIGN PER 704A2 PROCEDURE (TRANSMIT SEC. P10)

(f) Set to 20 kHz range and tune to 17 kHz. Adjust R6 (8000-0002-95) for minimum distortion.

(g) Set 110 kHz range and tune to 60 kHz. Adjust R7 (8000-0002-95) for minimum distortion.

4.37 Test - 1004 Hz:

(a) Set 704A to TRMT and 1004 Hz mode.

(b) Adjust R8 (8000-0002-95) for a frequency display of 1005 Hz.

(c) Adjust R9 (8000-0002-95) until the rms voltmeter reads 0.0 +/-0.1 dBm (600 ohm termination).

R4 ON NEW 295F 80

5. ENGINEERING DRAWINGS

5.01 This section contains the Halcyon engineering drawings required for maintenance of the 704A Wide Band Test Set and 705A Dial Hold Unit. The block and final assembly drawings are included first to aid in identifying the subassembly drawings that follow. The subassembly drawings are in numerical order as indicated by the four-digit base number and the two-digit suffix. All of the drawings required for each assembly or subassembly are grouped together, with the schematic diagram followed by the assembly drawing, bills of material, and wiring list as applicable. The drawings included are as follows:

0003-48 Wide Band Test Set Assembly, 704A (w/Battery)

0003-49 Wide Band Test Set Assembly, 704A (w/o Battery)

0003-72 Dial and Hold Assembly, 705A

0003-73 Wide Band Test Set Assembly, (w/Dial and Hold),704A (w/o Battery)

0003-74 Wide Band Test Set Assembly, 704A (w/o Battery, Dial and Hold)

0002-39 Battery Assembly 4.8V

0002-40 Battery Assembly 8.4V

0002-88 Receive Board

0002-89 Analog Measurement

0002-90 Impulse Board

0002-91 Display/Front Panel

0002-93 Digital Control

0002-94 Logic Board

0002-95 Transmitter Board

0002-96 Mother Board

0003-47 Enclosure Assembly

0003-52 Battery Option Kit Assembly

0003-65 Front Panel Assembly

0003-80 Cable Assembly, D/C Power

0004-34 Assembly Enclosure (w/o Dial and Hold)

1104-00 Power Supply Board

1122-25 Rear Panel Assembly

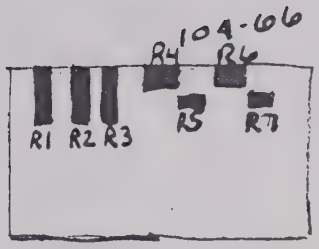
* New Style Transmit Board

TRANSMIT SECTION

14.0 Set up.

14.1 Set as in Table #4.

14.2 TABLE #4



14.3 Function switch level.
14.4 Function switch osc.
14.5 Rotary mode switch 600 ohms, 4Khz mode.
14.6 The remaining switches, set them to the left side.

14.7 TRANSMIT LEVEL CALIBRATION

14.8 Connect the output of the 704A2 to the 8810A DMM with 600 ohms shunt termination.

14.9 Tune the VCO to about 1 Khz.

14.10 Adjust the front panel level pot to make the level display just change from -0.0 to +0.0.

14.11 Adjust R5 on the (8K-0704-66) for 0.7746 vac into 600 ohms.

14.12 Switch from the vco over to the 1004Hz tone.

14.13 Adjust R4 on the (8K-0704-66) so that the level display just changes from -0.0 to +0.0.

14.14 Adjust R6 on the (8K-0704-66) for 0.7746 vac into 600 ohms.

14.15 Switch from the 1004 tone back to the vco.

14.16 Select the 110 KHz range.

14.17 Tune to 110 KHz.

14.18 Adjust the level pot to make the display just change from -0.0 to +0.0.

14.19 Adjust R7 to 0.7746 vac.

14.20 If you can't get the level down to 0.7746 vac with R7 fully counterclockwise, you'll have to select C10.

14.21 To select C10, try for the smallest value mica capacitor that will give a 110 Khz transmit level less than 0.7746 vac with R7 fully counterclockwise. DO NOT SOLDER NOW - WAIT UNTIL THE WHOLE TEST IS FINISHED, AND EVERYTHING ON THE BOARD IS WORKING CORRECTLY.

14.22 Adjust R7 for 0.7746 vac.

14.23 Tune to 10 KHz (on the 110 Khz range).

14.24 Set the transmitter to 135 ohms impedence.

14.25 Adjust the front panel level pot to make the display just change from -0.0 to +0.0.

14.26 The transmitter level into a 135 ohms load should measure between 0.359 and 0.376 vac. (-0.2 to +0.2 DBm 135)

14.27 Tune the transmitter to 110 Khz.

14.28 The level display probably will be between 0.0 and -0.2Db, (because of the roll off).

14.29 Adjust the front panel level pot to make the level display jsut change from -0.0 to +0.0.

14.30 The transmitter level into a 135 ohms load should be between 0.347 and 0.389 vac. (-0.5 to +0.5 dBm/135)

14.31 If the level is OK go to step 14.34.

14.32 FAILURE: If the level measures less than 0.347 vac, it may have to be replaced, and the board calibration redone from step 14.9.

14.33 If the level measures more than 0.389 vac, try a 10 pf to 22 pf capacitor at C9. Use the smallest value to cap that will get the transmitter level under 0.389 vac. DO NOT SOLDER C9 NOW - WAIT UNTIL THE TEST IS FINISHED.

14.34 Select 150 ohms transmitter impedence. The signal measured into a 150 ohms load should be between 0.366 and 0.410 vac. (± .5db)

14.35 Select 600 ohms transmitter impedence. The signal level measured into a 600 homs load should be between 0.731 and 0.828 vac. (± .5db)

14.36 Select 900 ohms transmitter impedence. The signal level measured into a 900 ohms load should be between 0.896 and 1.005 vac. (± .5db)

14.37 Select 1200 ohms transmitter impedence. The signal level measured into a 1200 ohms load should be between 1.034 and 1.160 vac. (± .5db)

14.38 Return 704A2 to 4Khz mode and 600 ohms transmitter impedence. Be sure the capacitor(s) are now soldered.

CHANGE NOTICE

MAINTENANCE PRACTICE
for the
704A WIDE BAND TEST SET
and
705A DIAL AND HOLD UNIT

Part Number: 4200-0024-01	Original Issue	Printed: 2/80

CHANGE DESCRIPTION: The following changes are applicable to the above manual.

1. Page 21, paragraph 4.23, step (f); change "....switches to 84." to "....switches to 82".

2. Page 21, paragraph 4.23, step (i); change "...switches to 80." to "...switches to 78."

3. Page 21, paragraph 4.23, step (k); change "...switches to 76." to "...switches to 74."

HALCYON

704A/705A MP
Change Notice 1
2 July 1980

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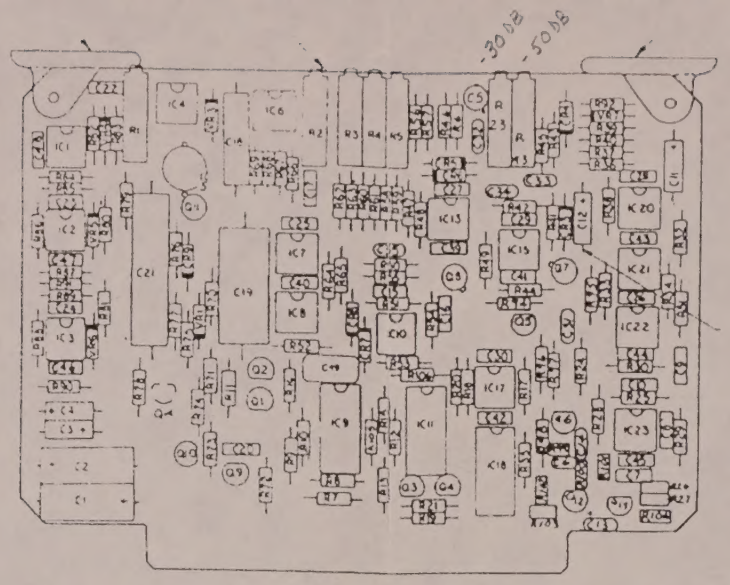
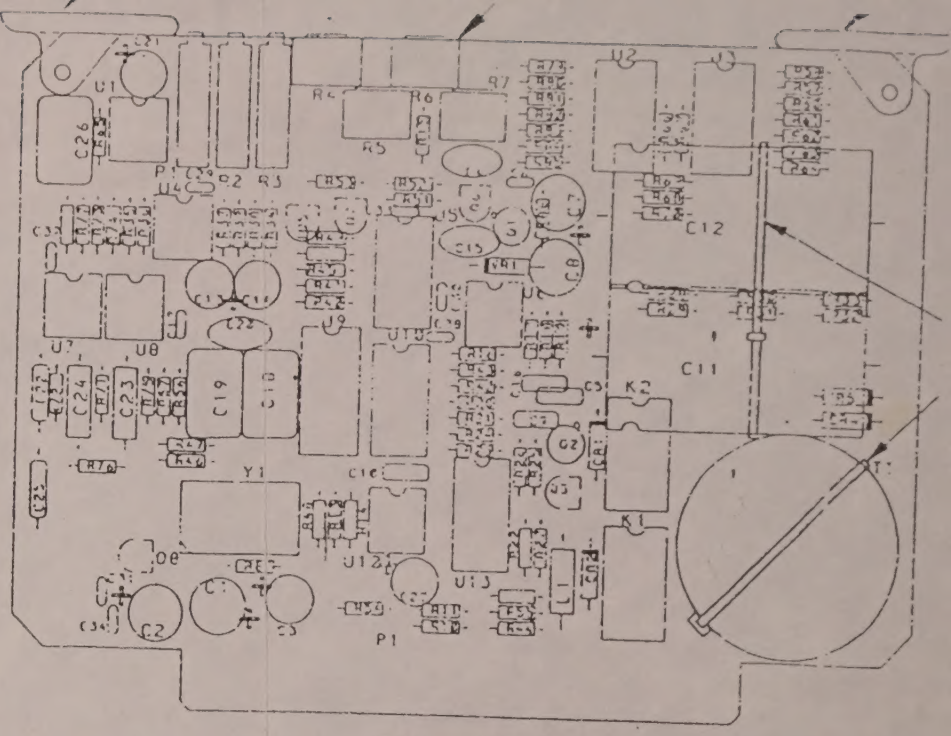
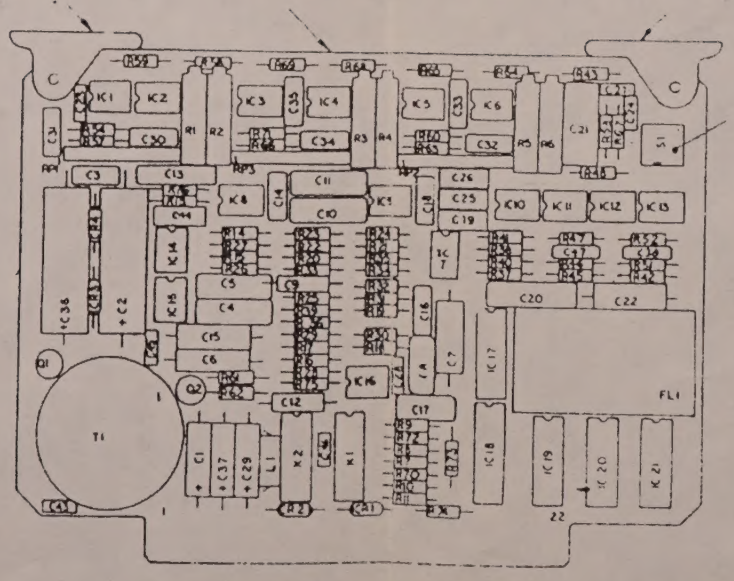


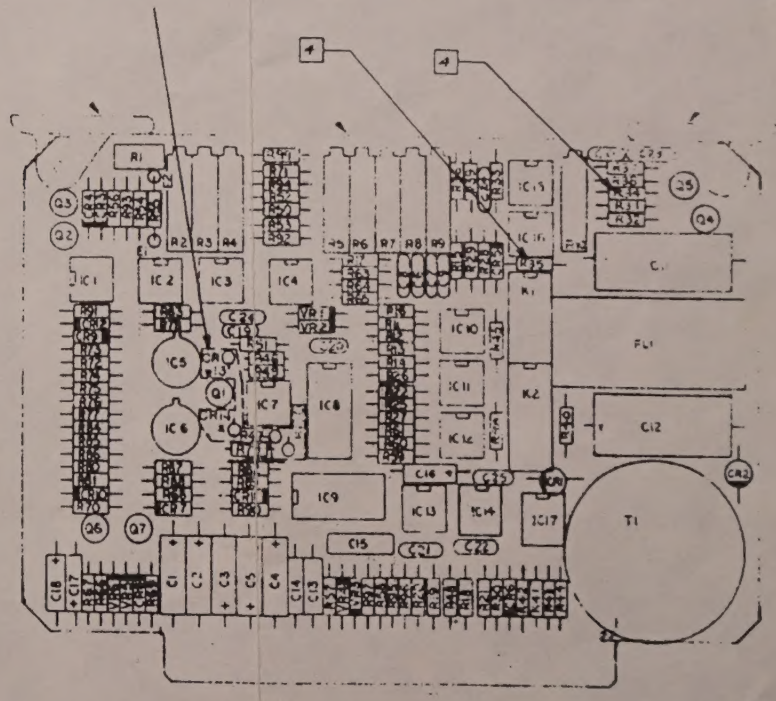
P.C.B. ASSEMBLY
ANALOG MEASUREMENTS



P.C.B. ASSEMBLY
TRANSMITTER BOARD
MODEL 704
(NEW STYLE)



P.C.B. ASSEMBLY
RECEIVE BOARD
(704)



TRANSMITTER BOARD
(OLD STYLE)

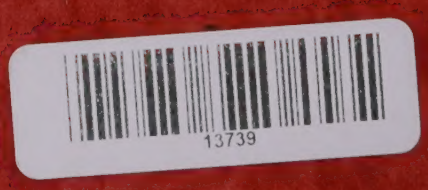
1.00

ACCOPRESS®

25970	YELLOW
25971	BLACK
25972	LIGHT BLUE
25973	DARK BLUE
25974	LIGHT GRAY
25975	LIGHT GREEN
25976	DARK GREEN
25977	TANGERINE
25978	RED
25979	EXECUTIVE RED

GENUINE PRESSBOARD

® ACCO INTERNATIONAL INC.
CHICAGO, ILLINOIS 60619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